Frequent sickness absence, a signal to take action

Notenbomer, Annette

CHAPTER

Factors associated with future long-term sickness absence among frequent absentees: A systematic review

4

Annette Notenbomer
Johan W. Groothoff
Willem van Rhenen

Submitted

Abstract

Background: Frequent sickness absence (SA), i.e. ≥3 SA spells in a year, is repetitive and related to long-term SA. The incidence of frequent SA in the working population is more than 5%. The main purpose of this review is to study which frequent absentees are at particular risk of long-term SA in order to know better whom to target for preventive actions.

Methods: We searched MEDLINE, EMBASE, PsycInfo, and Cinahl for prospective studies on adult workers who had ≥3 SA spells in one year, and long-term SA (lasting >1 week) in the follow-up period. Two authors independently carried out each step of this systematic review.

Results: Until now, no studies have focused specifically on risk factors of long-term SA among frequent absentees. We have included four studies, with frequent absentees as a subgroup. Gender, age and SA pattern were studied more extensively, whereas other variables were included only as confounders.

Conclusions: Articles on factors associated with future long-term SA among frequent absentees are scarce and based only on subgroups. We found indications that among frequent absentees female gender and older age may be factors associated with future long-term SA. However, no clear relation exists between SA pattern and long-term SA among frequent absentees. Other variables (total sick leave days, marital status, socioeconomic position, urban/rural workplace, seniority, fulltime/part-time employment, occupation, work factors and health care characteristics) were included only as co-variates, not allowing for any conclusions on their potential prospective contribution to future long-term SA.

Introduction

Frequent sickness absence (SA), defined as ≥3 SA spells in a year [1,2] is more common than long-term SA. In a total population of more than 600.000 employees working in companies contracted by a nationwide Dutch occupational health provider, the incidence of frequent SA was 5.8% in 2015 and 6.1% in 2016. In a study on the relationship between SA and work ability, 13% of the participants reported to have had ≥3 short spells in the prior year, 5% long-term SA, 3% mixed SA (frequent spells at least one of which was long-term) [3]. Not only is frequent SA repetitive over the years [4-7], but it is also related to long-term SA [8,9]. Frequent SA is therefore not only annoying for employers and co-workers [10], but also potentially costly in countries where employers are required to compensate SA financially.

Information in the literature on frequent SA is contradictory. On the one hand SA frequency has been proposed to be linked with a lack of motivation. When testing the Job-Demands Resources model, Schaufeli et al. found that changes in job demands were related to SA duration, whereas changes in job resources were related to SA frequency [11]. They explained this finding by assuming differing underlying mechanisms for SA duration and frequency. They used the term 'voluntary SA' for higher SA frequency as opposed to 'involuntary SA', which is related more to objective medical diseases and long-term SA. The authors found these findings remarkable, as generally correlations between SA frequency and duration are substantial (-0.05-.60) [12]. They themselves found a correlation of 0.38 between absence duration and absence frequency [11]. Flach et al. reported that frequent absentees (employees with ≥3 SA spells) in 2004 had a significantly higher risk of SA spells of 8-42 days and >42 days in 2005 [9]. Kivimaki et al. found that employees with >2 short (1-3 days) SA spells per year had a higher risk of disability pension in an average follow-up period of 5.1 years [8]. Based on data from the Stockholm Public Health Cohort, Hultin et al. reported that employees with ≥2 SA spells in 2002 had higher odds of long-term SA in 2007 [13]. The authors emphasized the importance of paying attention to short-term SA in order to prevent subsequent long-term SA. With a 5.8% incidence of frequent absenteeism in the workforce, not all frequent absentees are eligible for time-consuming preventive consultations with an occupational physician [14] or for coaching programs [15].

This raised the question of which frequent absentees would be likely to have future long-term SA. We performed a systematic review of the literature to identify and summarize the current state of knowledge on factors associated with future long-term SA among frequent absentees. Our goal was to enable employers and occupational health care providers to target preventive measures specifically at those frequent absentees at greatest risk of future long-term SA.

Methods

We filed the protocol for this systematic review in Prospero (CRD42014015632) and reported the review according to PRISMA guidelines 2009 [16].

Inclusion and exclusion criteria

We included studies with adult workers who had had at least three spells of SA in one year, and long-term SA in the follow-up period. Based on definitions from the large occupational cohorts of Whitehall II [17-19] long-term SA was defined as lasting >1 week. The reasons for SA were irrelevant, as well as whether frequent absentees were the main population studied or a subgroup. We excluded studies that did not specify the number of spells in one year, or that focused on mean group SA frequency in an organization instead of SA frequency of ≥3 SA spells in a year in individual employees. We also excluded studies that lacked a prospective design, such as cross-sectional studies. We included only articles in English.

Search methods

We included electronic searches and additional strategies to retrieve as many articles as possible.

Electronic searches

First, we gathered terms for the literature search from studies investigating frequent SA. We checked these terms with five international SA researchers to find additional search terms. We used terms relating to high frequency, long duration, and SA as well as terms indicative of a prospective design. We used these search terms to compose syntaxes for MEDLINE, EMBASE, PsycInfo, and Cinahl, and adapted the search terms from MEDLINE to fit the specific requirements of the other databases. We searched all publications until December 2014. Online Supplementary table S1 shows the specific search terms per database.

Searching other sources

From the articles retrieved as full papers we checked the introduction, discussion and references in an attempt to find additional studies.

Data collection and analysis

Selection of studies

As frequent SA is a relatively new subject in the literature, authors AN and JWG first performed a pilot study towards developing the search string, after which they developed a list of words possibly related to frequent sickness absence. We designed the list to include as many potentially

relevant articles as possible. This was especially important because SA frequencies are not often numerically described in the title or abstract, and no search strings have been previously developed for frequent sickness absence. AN and JWG then independently reviewed the title/abstract of all studies retrieved from the electronic database; they included the studies on employees with frequent or high SA rates and long-term SA during follow-up, independent of numeric definitions of frequencies or rates. When the authors did not agree on the inclusion of a study based on title/abstract, they discussed this. If this did not solve the disagreement, the study was included for full-text paper analysis to avoid missing potentially relevant studies.

We independently assessed in detail the selected full text papers. We excluded studies that did not meet the inclusion criteria, and documented the reasons for exclusion. When the two authors did not reach consensus on whether or not to include full text papers into the analysis they discussed their disagreement and consulted the third author (WvR).

Data extraction and management

From all articles that met our inclusion criteria, we extracted key information in a standardized form to characterize the study, including study setting and design, follow-up period, population, age, gender, response rate and loss to follow-up rates. We used a second form to extract the relevant information from the results, including definition of frequent SA, independent variables, and outcome variables of the studies. When only part of the study population met our inclusion criteria, we extracted the data of the relevant subgroup. We calculated incidence density ratios (IDR) and cumulative incidence ratios (CIR) from available data in the articles. Furthermore, we calculated relative risk ratios (RRR) according to Altman and Bland [20], using Hutchon's calculation tool [21].

Assessment of Methodological Quality

Two pairs of authors (AN and JWG, AN and WR) independently appraised the quality of the included studies, using a modified version of the quality assessment tool for prognostic studies, QUIPS, which is recommended by the Cochrane Prognosis Methods Group [22,23]. We rated studies for risk of bias in six domains: study participation, study attrition, prognostic factor measurement, outcome measurement, study confounding, and statistical analysis and reporting. We rated each of the six domains as having high, moderate, or low risk of bias. A low risk of bias means that the quality on that item is good. We scored a low risk of bias when there was evidence that the prognostic factor and outcome did not differ for completing and non-completing participants. When we had no information on differences between these groups we scored this as moderate risk of bias. We scored proven difference of association between prognostic factor

and outcome, between completing and non-completing participants, as high risk of bias. We solved differences in quality assessment between authors by discussion, and if still unresolved, by the third author. Supplementary material 1 gives an overview of the quality criteria scoring list.

Overview of level of evidence: although originally planned, this was not drawn up, as the number of studies did not allow for evaluation of prognostic factors for frequent absentees.

Risk of bias across studies: we planned no funnel plots, which was also not feasible due to the low number of studies.

Subgroup analysis, sensitivity analyses: we planned none, and due to the low number of studies this was also not feasible.

Results

Results of databases search

Figure 1 displays a PRISMA study flow chart of the inclusion process. The original electronic search resulted in 1207 studies. After excluding duplicates, the authors assessed the titles and abstracts of 796 studies for eligibility (Figure 1). As a result we included a total of 40 papers for full-text assessment. Total inter-observer agreement was 98% and inter-observer Cohen's kappa 0.72 (good). Checking the references, introductions and discussions of these papers led to one additional article, which had to be excluded upon full text assessment. From the full-text assessment of the other 40 articles, we excluded 36 papers for the following reasons: failure to meet the inclusion criterion of ≥3 SA spells in one year (n=25), non-English language (n=5), too little available information (poster publications, n=3), outcome parameter not long-term SA (n=2), and frequent SA not analyzed against long-term SA (n=1). Inter-observer agreement was 98% and Cohen's kappa 0.88 (excellent). As in all cases we reached consensus it was not necessary to consult the third author.

Included studies

Four studies were included in the review. All studies included frequent absentees as subgroups, but not as the main population. Table 1 summarizes the characteristics of the selected studies. All included studies reported an increased risk of long-term SA [24,25] and disability pension [25,26] in frequent absentees as compared to employees without frequent SA. Ishtiak-Ahmed

et al. reported a higher risk of disability pension in frequent absentees with sick leaves due to mental and somatic diagnoses, as compared to employees with only mental sick leave [27].

Figure 1. Prisma study flow chart of literature search and study selection

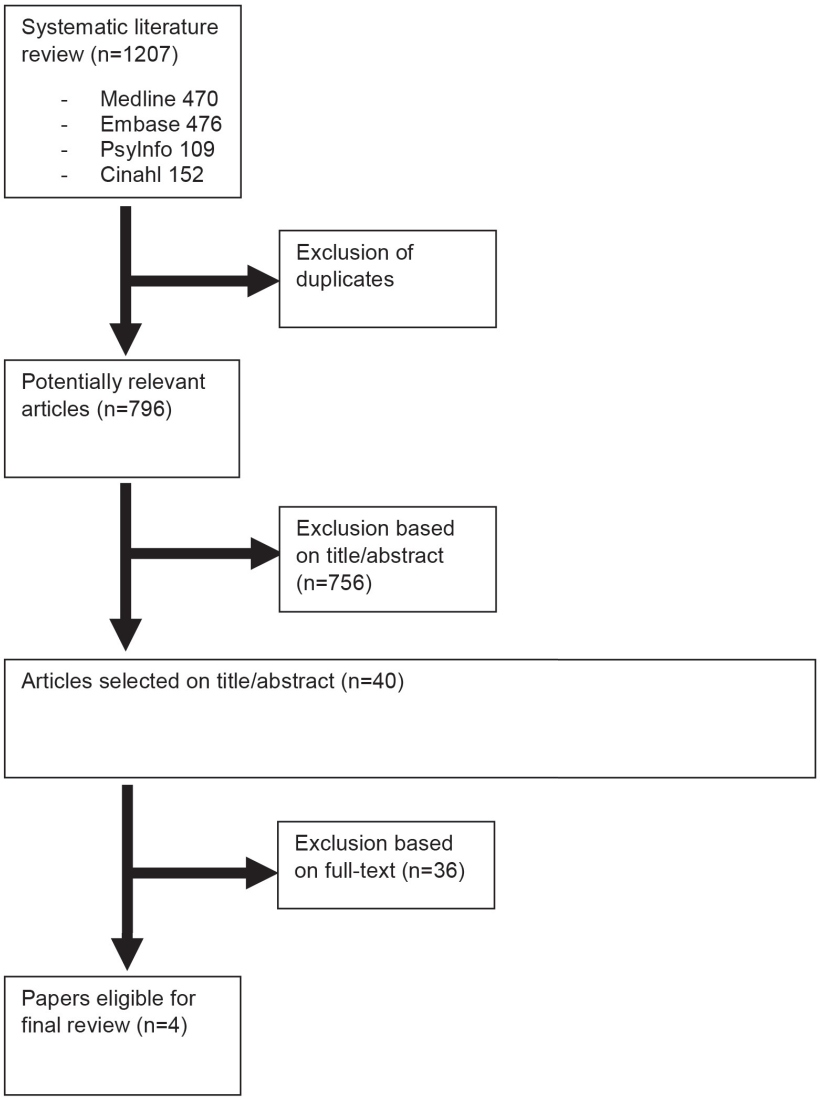

Table 1. Characteristics of the included studies

Study/year	Setting + design	Time of follow up	Type of frequent sickness absenteeism	n	Age	Sex, n	Response rate in entire study populations	% Loss to follow-up in entire study population
Koopmans et al. 2008 [24]	All employees of a Dutch postal and telecommunication company, n=53990. Register study, longitudinal. T0=1997	1998-2001	≥4 spells SA <6 weeks in 1997	4126	18-55 <35: 1300 35-44: 1705 45-54: 1121	Men: 2476 Women: 1650	100% (register data)	13%
			≥4 spells of SA AND long-term SA (≥6 weeks) in 1997	979	18-55 <35: 238 35-44: 394 45-54: 347	Men: 542 Women: 437	100% (register data)	13%
Koopmans et al. 2008 [26]	All employees of a Dutch postal and telecommunication company, n=53990. Register study, longitudinal. T0=1997.	1998-2001	≥4 spells SA<6 weeks in 1997	4126	18-55	Men: 2476 Women: 1650	100% (register data)	Men: 18.2% Women: 25.4%
			≥4 spells of SA AND long-term SA (≥6 weeks) in 1997	979	18-55	Men: 542 Women: 437	100%	Men: 18.2% Women: 25.4%

Stapelfeldt et al. 2014 [25]	All eldercare employees who worked entire year of 2004 in municipality of Aarhus, Denmark, n=2774. Longitudinal study,T0=2004. Combination register+ questionnaire)	1-1-2006 to week 39 in 2012 (2005= wash-out period)	3-17 short (1-7 days) spells in 2004	522	≤ 40: 175 >40: 347	NA	76%	13.7% in wash-out period
			2-13 mixed spells, combination of short (1-7 days) and long (≥7 days) spells[1]	454	≤40: 102 >40: 361	NA	76%	13.7% in wash-out period
Ishtiak et al. 2014 [27]	All Swedish individuals with ≥1 SA spell due to a stress-related mental disorder initiated in 2005. n=36304. Register study, longitudinal, T0=2005	2006-2010 Mean follow-up 4.6 years	≥3 spells in a year, of which ≥1 mental and ≥2 somatic	388	16-64 years for total population	NA	100% (register data)	8.2%

[1]No information is available on sample size of the group with frequent short SA with 5-17 short spells or frequent mixed SA with 5-13 mixed spells

Study population and study setting

All four studies were register-based and undertaken in Northern-European countries: the Netherlands (n=2), Denmark (n=1) and Sweden (n=1). The two Dutch studies by Koopmans et al. were based on the same data, but had different research questions and outcome variables [24,26]. They studied 4126 frequent absentees working in postal distribution and transport nationwide in 1997 and followed them for four years, from 1998 to 2001. The Danish study by Stapelfeldt et al. included 522 frequent absentees working in elder care in one town in Denmark in 2004 and followed them from 2006 to 2012 [25]. The Swedish study of Ishtiak-Ahmed et al. included frequent absentees as a subgroup (n=388) of Swedish employees with SA due to mental-related disorders in 2005, and followed them from 2006 to 2010 [27].

Study design and independent variables

All included studies had a prospective design, which was a selection criterion for inclusion. The independent variables from the studies of Koopmans et al.[24,26] and Ishtiak et al. [27] were register-based. Stapelfeldt used register-based data for SA, age and occupation and questionnaire-based work factors [25].

Types of frequent SA

Koopmans et al. defined frequent SA as ≥4 SA spells lasting <6 weeks in a year, and mixed SA as ≥4 SA spells in a year, with at least one SA spell lasting 6 weeks or longer [24,26]. Stapelfeldt et al. defined frequent SA as ≥3 short (1-7 days) SA spells in a year [25]. In a sensitivity analysis they defined frequent SA as ≥5 SA spells per year and mixed SA as ≥5 SA spells per year, with at least 1 SA spell lasting >7 days. Ishtiak-Ahmed et al. defined frequent SA as ≥3 SA spells in a year, of which at least one was due to mental disorders and at least one to somatic disease [27].

Outcome measurements

The definitions of long-term SA falling within our inclusion criterion of > 1 week varied across the studies. Koopmans et al. defined long-term SA as lasting ≥6 consecutive weeks [24] or ≥1 year of SA [26], and labeled the latter work disability. Stapelfeldt et al. had two outcome measures: long-term SA, lasting ≥9 consecutive weeks of SA, and granting of disability pension [25]. Usually, the latter took place after 12 months SA [28]. Ishtiak-Ahmed et al. also defined long-term SA in terms of granted disability pension [27]; in Sweden, this also usually takes place after 12 months SA [29].

Methodological quality

All studies had methodological strengths in using employer- or national registries to measure independent variables and outcome measures, as well as large samples, adjustment for potential

confounders, and all had appropriate statistical designs. However, all studies suffered from attrition, some of which resulted in evidence of bias. The results of quality assessment are shown in table 2 as risk of bias, based on adapted QUIPS criteria [22,23].

Table 2. Risk of bias per study

	Koopmans et al. 2008 [24]	Koopmans et al. 2008 [26]	Stapelfeldt et al. 2014 [25]	Ishtiak-Ahmed et al. 2014 [27]
Study participation	moderate	moderate	moderate	moderate
Study attrition	high	moderate	high	moderate
Risk factor measurement	low	Low	low	moderate
Outcome measurement	low	Low	low	low
Study confounding	low	Low	low	low
Statistical analysis & reporting	low	Low	low	low

Low risk of bias means that the quality of the study on that issue is good. For method of rating, see appendix 2

Factors associated with future long-term SA

All articles included frequent absentees as subgroups, but none as the main population. All articles contained direct or indirect relevant information on factors associated with long-term SA among frequent absentees. We used absolute data and ratios, comparing frequent absentees with the reference groups 'employees with neither frequent SA nor long-term SA'. Where possible, we calculated CIRs, IDRs or RRRs for frequent absentees in order to present information on relative risk, in cases of articles that did not provide these data for this subgroup. Table 3 summarizes the relevant information as reported in the articles.

Age

All four studies investigated age as independent variable for future long-term SA and disability pension. Koopmans et al. [24] used age only as a confounder when calculating the relative risk (RR) of long-term SA. In their other study, Koopmans et al. [26] reported that frequent absentees had a higher absolute risk (increasing with age) of disability pension as compared to employees without frequent or long-term SA. Stapelfeldt et al. used age as a confounder when calculating RR of disability pension or long-term SA, but did not report the impact of age as confounder on the subgroup of frequent absentees [25]. Ishtiak-Ahmed et al. stratified their analyses for age

(≤45 years versus >45 years) and reported that frequent absentees with mental and somatic sick leaves aged >45 years, but not those aged ≤45 years, had a higher risk of disability pension than employees with only mental sick leave [27]. There are therefore indications that among frequent absentees older age may be a factor associated with future long-term SA or disability pension.

Gender

Three studies [24,26,27] included gender as independent variable for long-term SA and disability pension. Women had a higher absolute and relative risk of long-term SA and disability pension than did men. For frequent absentees, we calculated IDR=1.35 (95% CI 1.26 – 1.45) for long-term SA [24] and CIR=1.60 (95% CI 1.34 – 1.91) for disability pension [26], comparing female to male frequent absentees. Ishtiak-Ahmed et al. used gender as a confounder but did not report gender data for frequent absentees [27].

Sickness absence pattern

Three studies included SA pattern as an independent variable [24-26]. Patterns studied were frequent SA with only relatively short SA spells ('frequent SA') and frequent SA with at least one long spell ('frequent mixed SA'). Koopmans et al. [24] reported higher incidence rates of long-term SA for both men and women when comparing employees with mixed frequent SA to employees with frequent SA. When calculating IDR we found that employees (men and women combined) with mixed frequent SA had a significantly higher risk of long-term SA than employees with only frequent SA (IDR=1.17, 95% CI [1.09-1.26]). However, in regression analyses, after adjustment for age, civil status, urban/rural workplace, full-time/part-time, salary scale, seniority and company, when comparing the RR of men with frequent mixed SA to the RR of men with frequent SA we calculated no significant difference (RRR=1.05, 95% CI 0.96-1.16); we also found a lower risk for women with frequent mixed SA versus those with frequent SA (RRR= 0.8, 95% CI 0.72-0.89). In the study by Koopmans et al. [26] on risk of work disability, the absolute risks of work disability, i.e. SA>1 year, were higher in employees with frequent mixed SA than in those with frequent short-term SA in both men and women, also when stratified across age groups. Calculations from their data show a significantly higher risk in employees (men and women combined) with frequent mixed SA compared to those with frequent SA (CIR=2.84, 95% CI [2.50-3.23]). Koopmans et al. [26] also calculated hazard ratios (HRs) from regression analyses, adjusting for various confounders (civil status, working full-time/part-time, salary scale, seniority and urbanization level). For each age group, HRs of work disability of frequent absentees with mixed SA were also much higher than in the groups with frequent SA. Stapelfeldt et al. [25] investigated the risk of both long-term SA and disability pension, stratified by SA pattern (5-13 mixed spells, 5-17 short spells) compared to a reference group of employees with 0-2 short

SA spells. In comparison to a reference group without frequent or long-term SA, they found a higher RR of disability pension and long-term SA risk in employees with frequent mixed SA than in employees with only short-term frequent SA. These were their findings after adjustment for age, occupation, unfavorable work factors (work pace, emotional demands, demands for hiding emotions, physical workload, role conflict, influence on work, commitment to work, meaning of work, and quality of leadership) and total sick leave days. However, the difference in RR between employees with frequent mixed SA (compared to the reference group) and frequent absentees (compared to the reference group) was not significant; calculated RRR for DP was 1.31 (95% CI 0.12-96.92) and RRR 1.21 (95% CI 0.71-2.08) for long-term SA. For frequent absentees there is no clear relation between SA pattern and future long-term SA.

Other potential relevant factors

All four studies included proxies of socioeconomic status as covariates in the analyses, but did not investigate socioeconomic status as independent variable for long-term SA and disability pension; three studies [24,26,27] included marital status as a covariate in these analyses. Two studies included total number of SA days in their analyses [25,27]. Stapelfeldt et al. [25] used total number of SA days as a confounder in a step-up regression analysis. The risk of long-term SA and disability pension for frequent absentees decreased when correcting for total annual number of SA days, but due to broad 95% confidence intervals the decrease in the risk of disability pension was not significant. Ishtiak-Ahmed et al. [27] showed an increased risk of disability pension with increasing duration of SA, length of hospital stays, and number of outpatient care visits, but data were not specified for frequent absentees.

Koopmans et al. [24,26] included the type of workplace (urban/rural), seniority and fulltime/parttime employment in their analyses of the risk of long-term SA and disability pension. Stapelfeldt et al. [25] used questionnaire data on the working environment (work pace, emotional demands, demands for hiding emotions, physical workload, influence on work, meaning of work, commitment to the workplace, role conflict, and quality of leadership), dichotomized into favorable/unfavorable work factors. The authors reported higher risks of long-term SA, but not disability pension, for employees exposed to more unfavorable work factors, but these results were not specified for frequent absentees. Ishtiak-Ahmed et al. [27] reported a higher risk of disability pension for employees born in countries outside the EU and employees living in medium-sized or small towns, but these data were also not specified for frequent absentees. Likewise, the length of a hospital stay and frequency of outpatient care visits increased the risk of disability pension, but the data were not specified for frequent absentees. Supplementary table S2 gives an overview of all included variables per study.

Table 3. Outcome, independent variables and results

Author, year	Independent SA measure, spells per year	Outcome parameter	Covariates	Independent variables	Results
Koopmans et al. 2008 [24]	≥4 spells	Long-term absence (≥6 weeks)	Age Marital status Urban/rural workplace Working full-time/part-time Salary scale Seniority	Gender	*Absolute risk women>risk men* Incidence rate long-term SA: 27.3 vs 20.2 per 100 work-years
				SA pattern: mixed frequent spells with ≥1 spell of ≥6 weeks vs frequent (short) SA, with spells <6 weeks	*Absolute risk frequent mixed SA > frequent (short) SA* Incidence rate long-term SA Men: 34.3 vs 20.2 per 100 work-years: Women: 37.2 vs. 34.3 per 100 work-years
Koopmans et al. 2008 [26]	≥4 spells	Work disability (SA> 1 year)	Marital status Urban/rural workplace Working full-time/part-time Salary scale Seniority	Gender	*Absolute risk women>men* Disability rate 4.2 vs 2.5 per 100 employee-years.
				Age	*Absolute risk increases with age: Work disability rate per 100 work-employee-years* Men: <35: 1.2; 35-44: 2.2; 45-54: 3.7 Women: <35: 3.4; 35-44: 3.7; 45-54: 6.3
				SA pattern	*Hazard ratio: risk frequent mixed > frequent short spells* Men<35: 8.6 vs 1.2; 35-44: 7.8 vs 2.2; 45-54: 8.3 vs 3.7 Women<35: 7.8 vs 3.4; 35-44: 11.3 vs 3.7; 45-54: 12.8 vs 6.3

Stapelfeldt et al. 2014 [25]	3-17 short (1-7 days) spells	Granted Disability pension (DP) Long-term sick leave: ≥ 9 Weeks	Age Occupation (care/non-care) Unfavorable work factors Total sick leave days	SA pattern[1]	*Risk DP frequent mixed > frequent short SA* RR 5.2 (0.1-333.7) vs 4.2 (1.0-17.9) *Risk long-term SA frequent mixed > short mixed SA* RR 1.7 (1.1-2.6) vs 1.4 (1.0-1.9)
Ishtiak et al. 2014 [27]	≥3 spells in a year, of which ≥1 mental and ≥2 somatic	Granted all-cause disability pension	Age Gender Education Country of birth Place of residence (size) Type of family Total sick leave days Length of hospital stay Outpatient care visits		

[1] *Based on data from sensitivity analyses: 5-13 mixed SA (≥1 spell of >7 days) vs 5-17 short SA (only spells <8 days)*

Discussion

Main findings

This systematic review of the literature investigated factors associated with future long-term SA among frequent absentees. From the literature we retrieved four moderate-to-good quality articles. These articles did not specifically focus on risk factors of long-term SA among frequent absentees but included frequent absentees as subgroups. All four papers report that frequent absentees are at risk of long-term SA. Moreover, we found that older age and female gender may be factors associated with long-term SA among frequent absentees. Among frequent absentees no clear relation exists between SA pattern with one prior long-term SA spell and follow-up long-term SA. The other variables included in the four original articles (total sick leave days, marital status, socioeconomic position, urban/rural workplace, seniority, fulltime/part-time employment, occupation, unfavorable work factors such as too many demands or too little resources, and health care characteristics) may be risk factors, but the data presented did not allow for drawing any conclusions.

Comparison with other studies

To our knowledge, no other reviews present the factors associated with future long-term SA among frequent absentees. However, some systematic reviews of the literature have reported factors associated with long-term SA or disability pension in other employee populations [30-33]. Our findings on associations between older age and future long-term SA and gender and long-term SA are consistent with these systematic reviews [30-33]. Two systematic reviews reported a weak [30], respectively limited [31], evidence for a positive association of prior long-term SA (>100 days) with future long-term SA, whereas we found no clear association between prior long-term SA and future long-term SA among frequent absentees.

Quantity and quality of evidence

Although the number of studies was too small to draw robust conclusions, the number of participants per study was high. Despite the small number of studies, the topic of frequent absenteeism is very relevant in the Netherlands and some other Northern European countries. In yet other countries frequent SA may attract less attention if SA is not registered from the first SA day; this can lead to under-registration of SA episodes and therefore much lower incidences of frequent SA.

The quality of the studies was moderate to good. The highest risk of bias stemmed from attrition. Although attrition rates were not very high in most studies due to the reasons for attrition

(exit from job, early pension, pension, wash-out year of participants with long SA within a year after inclusion), we cannot rule out systematic difference between groups who did or did not participate for the entire period. Stapelfeldt et al. [25] had a wash-out period of 1 year, excluding employees with long-term spells starting before the follow-up year. Koopmans et al. [26] reported that employees with mixed SA have a higher risk of long-term SA and a higher risk of exit, which might have led to underreporting of long-term SA in the follow-up period.

Potential biases in the review process

We could not investigate publication bias because with only four studies funnel plot analysis is not possible. Publication bias seems unlikely though. In individual studies subgroup analysis can lead to biased results due to low power in case of a low number of participants in the subgroup, or due to an increased chance of finding positive results for a subgroup when studying many subgroups. The studies we included had substantial numbers of participants per subgroup. For most studies the number of subgroups was not very high, reducing the likelihood of finding a positive result by pure chance. We therefore do not regard subgroup analyses as a risk of bias for the included studies. We restricted our review to studies written in English, excluding five articles written in other languages from full-text analysis. However, based on the title and abstract of the excluded articles we had no indication that their inclusion would have affected our results.

Additional methodological considerations of the review

The review included only four studies, all of them carried out in Northern-European countries. Populations in the studies by Koopmans et al. [24,26] and Stapelfeldt et al. [25] were confined respectively to one large postal organization and eldercare workers. Therefore, it is unclear whether the results of this review are generalizable to other countries or to the entire working population within the studied countries. Another limitation was that the different articles used different definitions of frequent SA. Possibly, the exact number of SA spells may be relevant for the risk of future long-term SA, an issue suggesting a need for further research.

In general, the studies were of moderate-to-good quality. Our subjects of research, frequent absentees, were included only as subgroups. Original studies on frequent absentees would have revealed more information. In order to get more information from the data presented in the articles, we calculated relative risks (IDR, CIR, RRR) for frequent absentees. Calculating RRRs revealed new, relevant information on the relation between SA pattern and long-term SA.

Implications for practice (OH providers and organizations, employees)

We advise that at least employees who have ≥ 3 SA spells a year and who are older than 45 years get more attention from their organization and OH providers to undertake joint action to prevent long-term absenteeism. Although frequently absent women have a higher risk to develop long-term SA than frequently absent men, we deem this group too large to invite them all for preventive consultations. In order to enable more focused preventive actions for women, further research is needed to identify the high risk group among female frequent absentees.

Implications for research

More research with an appropriate design is needed to study the risk factors of frequent absentees at risk of long-term absenteeism. In such studies, additional potential risk factors should be included, such as health-related factors known to be related to long-term SA in general populations of employees. Additionally, more research is needed on the effect of prior SA: the number of SA episodes, length of prior spells, total number of days or historical SA pattern over the years. Future prediction studies among frequent absentees should also address differences in risk profiles for men and women, possibly resulting in separate prediction models for men and women. Future research can also provide more clarity on the cut-off point of age in the high risk group. Frequently absent employees aged 35-45 seem at greater risk of long-term SA than their peers with low SA, but this risk is lower than in frequent absentees >45 years compared to their peers [26].

Conclusions

Studies on factors associated with long-term SA among frequent absentees are few. We included four studies of moderate-good quality. In these studies, frequent absentees were not the unit of analysis but were used as subgroups. Although frequent absentees were not the main subject of interest, the articles included data on factors associated with future long-term SA for the subgroups of frequent absentees. Based on incidence rates, hazard ratios, CIR and IDR calculations, a clear and consistent pattern was present in all these studies: frequently absent women have a higher risk of long-term SA than frequently absent men; older age groups have a higher risk of long-term SA than younger age groups; employees with frequent mixed SA have a higher risk of long-term SA than those with relatively short spells. When calculating RRRs from regression analyses that corrected for confounders, we found conflicting results on mixed frequent SA as a factor to be associated with future long-term SA. These results indicate that we cannot draw robust conclusions on factors associated with future long-term SA among frequent absentees.

References

1. Roelen CA, Bültmann U, van Rhenen W, et al. External validation of two prediction models identifying employees at risk of high sickness absence: cohort study with 1-year follow-up. BMC Public Health 2013;13:105.
2. Notenbomer A, Roelen CA, van Rhenen W, et al. Focus group study exploring factors related to frequent sickness absence. Plos One 2016;11(2):e0148647.
3. Notenbomer A, Groothoff JW, van Rhenen W, et al. Associations of work ability with frequent and long-term sickness absence. Occup Med 2015;65:373-379.
4. Roelen CA, Koopmans PC, Schreuder JA, et al. The history of registered sickness absence predicts future sickness absence. Occup Med 2011;61:96–101.
5. Roelen CA, van Rhenen W, Bültmann U, et al. The development and validation of two prediction models to identify employees with high sickness absence. Eur J Public Health 2013;23:128–133.
6. Roelen CA, Stapelfeldt CM, Heymans MW, et al. Cross-national validation of prognostic models predicting sickness absence and the added value of work environment variables. J Occup Rehabil 2015;25:279-287.
7. Roelen CAM, Bültmann U, Stapelfeldt CM, et al. Multicentre validation of frequent SA predictions. Occup Med 2016;66:69-71.
8. Kivimaki M, Forma P, Wikstrom J, et al. Sickness absence as a risk marker of future disability pension: the 10-town study. J Epidemiol Community Health 2004;58:710–711.
9. Flach PA, Krol B, Groothoff JW. Determinant of sick leave duration: a tool for managers? Scand J Public Health 2008;36:713-719.
10. Eakin JM, MacEachen E. Health and the social relations of work: a study of the health-related experiences of employees in small workplaces. Soc Health Illn 1998;20:896–914.
11. Schaufeli WB, Bakker AB, van Rhenen W. How changes in job demands and resources predict burnout, work engagement, and sickness absenteeism. J Organ Behav 2009;30: 893–917.
12. Farrell D, Stam, CL. Meta-analysis of the correlates of employee absence. Human Relations 1988;41:211–227.
13. Hultin H, Lindholm C, Malfert M, et al. Short-term sick leave and future risk of sickness absence and unemployment – the impact of health status. BMC Public Health 2012;12:861.
14. Kant IJ, Jansen NWH, van Amelsvoort LGPM, et al. Structured early consultation with the occupational physician reduces sickness absence among office workers at high risk for long-term sickness absence: a randomized controlled trial. J Occup Rehabil 2008;18:79–86.

15. Duijts SF, Kant I, van den Brandt PA, et al. Effectiveness of a preventive coaching intervention for employees at risk for sickness absence due to psychosocial health complaints: results of a randomized controlled trial. J Occup Environ Med 2008;50:765–776.

16. Moher D, Liberati A, Tetzlaff J, et al; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Ann Intern Med 2009;151:264-269.

17. North FM, Syme SL, Feeney A, et al. Psychosocial work environment and sickness absence among British civil servants: the Whitehall II study. Am J Public Health 1996;86:332-340.

18. Stansfeld S, Feeney A, Head J, et al. Sickness absence for psychiatric illness: the Whitehall II Study. Soc Sci Med 1995;40:189-197.

19. Head J, Kivimäki M, Martikainen P, et al. Influence of change in psychosocial work characteristics on sickness absence: The Whitehall II Study. J Epidemiol Community Health 2006;60:55-61.

20. Altman DG, Bland JM. Interaction revisited: the difference between two estimates. BMJ 2003;326:219 .

21. Hutchon DJR. Calculations for comparing two estimated relative risks. 2015. http://www.hutchon.net/CompareRR.htm. Accessed 21-10-2016.

22. Hayden JA, van der Windt DA, Cartwright JL, et al. Assessing bias in studies of prognostic factors. Ann Intern Med 2013;158:280-286.

23. Moulaert VR, Verbunt JA, van Heugten CM, et al. Cognitive impairments in survivors of out-of-hospital cardiac arrest: A systematic review. Resuscitation 2009;80:297-305.

24. Koopmans PC, Roelen CA, Groothoff JW. Risk of future sickness absence in frequent and long-term absentees. Occup Med 2008;58:268-274.

25. Stapelfeldt CM, Nielsen CV, Andersen NT, et al. Sick leave patterns as predictors of disability pension or long-term sick leave: a 6.75-year follow-up study in municipal eldercare workers. BMJ Open 2014;4(2):e003941.

26. Koopmans PC, Roelen CAM, Groothoff JW. Frequent and long-term absence as a risk factor for work disability and job termination among employees in the private sector. Occup Environ Med 2008;65:494-499.

27. Ishtiak-Ahmed K, Perski A, Mittendorfer-Rutz E. Risk markers of all-cause and diagnosis-specific disabilitiy pension – a prospective cohort study of individuals sickness absent due to stress-related mental disorders. BMC Public Health 2014;14:805.

28. Lund T, Kivimaki M, Labriola M, et al. Using administrative sickness absence data as a marker of future disability pension: the prospective DREAM study of Danish private sector employees. Occup Environ Med 2008;65:28-31.

29. Zetterström K. Disability pension among patients undergoing coronary revascularization. Dissertation, Karolinska Institute Stockholm, 2015. https://openarchive.ki.se/xmlui/bitstream/handle/10616/44601/Thesis_Katharina_Zetterstr%C3%B6m.pdf?sequence=2.

30. Dekkers-Sánchez PM, Hoving JL, Sluiter JK, et al. Factors associated with long-term sick leave in sick-listed employees: a systematic review. Occup Environ Med 2008;65:153-157.

31. Cornelius LR, van der Klink JJ, Groothoff JW, et al. Prognostic factors of long term disability due to mental disorders: a systematic review. J Occup Rehabil 2011;21:259-274.

32. Detaille SI, Heerkens YF, Engels JA, et al. Common prognostic factors of work disability among employees with a chronic somatic disease: a systematic review of cohort studies. Scand J Work Environ Health 2009;35:261-281.

33. Steenstra IA, Verbeek JH, Heymans MW, et al. Prognostic factors for duration of sick leave in patients sick listed with acute low back pain: a systematic review of the literature. Occup Environ Med 2005;62:851-860.

Supplementary Table S1. Search terms per database

	Frequent	Sickness absence	Long	Prospective design
Medline	recurr*[tw] OR numerous[tw] OR repeat*[tw] OR repetitive[tw] OR frequent[tw] OR high frequency[tw] OR high rate*[tw] OR high incidence[tw]	("Sick Leave"[Mesh] OR "Absenteeism"[Mesh] OR (sick*[tw] AND leave*[tw]) OR absenteeism[tw] OR sickness absence*[tw] OR days off work[tw] OR work disability[tw]) NOT school absenteeism[tw]	prolong*[tw] OR long[tw] OR longer[tw] OR long-term[tw] OR duration*[tw] OR "Return to Work"[Mesh] OR return to work[tw]	prosp* OR longit* OR cohort OR predic* OR progn* OR determin* OR factor*
Embase	recurr*:ab,ti OR numerous:ab,ti OR repeat*:ab,ti OR repetitive:ab,ti OR frequent:ab,ti OR 'high frequency':ab,ti OR 'high rate':ab,ti OR 'high rates':ab,ti OR 'high incidence':ab,ti	('work disability'/exp OR 'medical leave'/exp OR 'absenteeism'/exp OR (sick*:ab,ti AND leave*:ab,ti) OR 'sick leave':ab,ti OR 'sick leaves':ab,ti OR absenteeism:ab,ti OR 'sickness absence':ab,ti OR 'sickness absences':ab,ti OR 'days off work':ab,ti OR 'work disability':ab,ti) NOT 'school absenteeism'	prolong*:ab,ti OR long*:ab,ti OR duration*:ab,ti OR 'return to work'/exp OR 'return to work'	prosp*:ab,ti OR longit*:ab,ti OR cohort:ab,ti OR predic*:ab,ti OR progn*:ab,ti OR determin*:ab,ti OR factor*:ab,ti
PsycINFO	TI (recurr* OR numerous OR repeat* OR repetitive OR frequent OR high frequency OR high rate* OR high incidence) OR AB (recurr* OR numerous OR repeat* OR repetitive OR frequent OR high frequency OR high rate* OR high incidence)	(DE "Employee Absenteeism" OR TI ((sick* AND leave*) OR absenteeism OR "sickness absence*" OR "days off work" OR "work disability") OR AB ((sick* AND leave*) OR absenteeism OR "sickness absence*" OR "days off work" OR "work disability")) NOT "school absenteeism"	TI (prolong* OR long* OR duration* OR "return to work") OR AB (prolong* OR long* OR duration* OR "return to work")	TI (prosp* OR longit* OR cohort OR predic* OR progn* OR determin* OR factor*) OR AB (prosp* OR longit* OR cohort OR predic* OR progn* OR determin* OR factor*)
Cinahl	TI (recurr* OR numerous OR repeat* OR repetitive OR frequent OR high frequency OR high rate* OR high incidence) OR AB (recurr* OR numerous OR repeat* OR repetitive OR frequent OR high frequency OR high rate* OR high incidence)	((MH "Sick Leave") OR (MH "Absenteeism") OR TI ((sick* AND leave*) OR absenteeism OR "sickness absence*" OR "days off work" OR "work disability") OR AB ((sick* AND leave*) OR absenteeism OR "sickness absence*" OR "days off work" OR "work disability")) NOT "school absenteeism"	(MH "Job Re-Entry") OR TI (prolong* OR long* OR duration* OR "return to work") OR AB (prolong* OR long* OR duration* OR "return to work")	TI (prosp* OR longit* OR cohort OR predic* OR progn* OR determin* OR factor*) OR AB (prosp* OR longit* OR cohort OR predic* OR progn* OR determin* OR factor*)

Supplementary Material 1 Quality criteria scoring list

Domain 1: Study Participation

Goal: To judge the risk of selection bias (likelihood that relationship between PF and outcome is different for participants and eligible non-participants).

Study Participation Summary question:

After thorough reflection on all considerations, how would you describe the judgement about the risk of selection bias (i.e. distortion due to relationship between the prognostic factor and outcome being different for participants and eligible non-participants)?

☐ Low risk of bias ☐ Moderate risk of bias ☐ High risk of bias

Low risk of selection bias – due to:

- Complete participation by those eligible to participate
- Incomplete participation, but there is evidence that participation was not likely to be related to the prognostic factor and outcome (there is evidence that relationship between the prognostic factor and outcome are not different for participants and eligible non-participants).

Domain 2: Study Attrition

Goal: To judge the risk of attrition bias (likelihood that relationship between PF and outcome are different for completing and non-completing participants).

Study Attrition Summary question:

After thorough reflection on all considerations, how would you describe the judgement about the risk of attrition bias (i.e. distortion in study results due to relationship between the prognostic factor and outcome being different for completing and non-completing participants)?

☐ Low risk of bias ☐ Moderate risk of bias ☐ High risk of bias

Low risk – due to:

- There was no loss to follow-up,

- There is some loss to follow-up, but there is evidence that follow-up was not likely to be related to the prognostic factor and outcome (there is evidence that prognostic factor and outcome are not different for completing and non-completing participants).

Domain 3: Prognostic factor Measurement

Goal: To judge the risk of measurement bias related to how the prognostic factor was measured (differential measurement of the prognostic factor related to the outcome).

Outcome Measurement Summary question:

After thorough reflection on all considerations, how would you describe the judgement about the overall risk of measurement bias due to the outcome measure?

☐ Low risk of bias ☐ Moderate risk of bias ☐ High risk of bias

Low risk – due to:

- Measurement of the outcome is valid, reliable and similar for all subjects
- There are differences or uncertainty in measurement of the prognostic factor but there is evidence that it is not likely to affect the relationship between the prognostic factor and outcome.

Domain 4: Outcome Measurement

Goal: To judge the risk of bias related to the measurement of outcome (differential measurement of outcome related to the baseline level of prognostic factor).

Outcome Measurement Summary question:

After thorough reflection on all considerations, how would you describe the judgement about the overall risk of measurement bias due to the outcome measure?

☐ Low risk of bias ☐ Moderate risk of bias ☐ High risk of bias

Low risk – due to:

- Measurement of the outcome is valid, reliable and similar for all subjects
- There are differences or uncertainty in measurement but there is evidence that it is not likely to affect the relationship between the prognostic factor and outcome.

Domain 5: Study Confounding

Goal: To judge the risk of bias due to confounding (i.e. the effect of PF is distorted by another factor that is related to PF and outcome).

Study Confounding Summary question:

After thorough reflection on all considerations, how would you describe the judgement about the overall risk of bias due to confounding?

☐ Low risk of bias ☐ Moderate risk of bias ☐ High risk of bias

Low risk – due to:

- Inclusion and assessment of confounding was planned by theory, included valid and reliable measures and were appropriately controlled in the design and/or analysis.

Domain 6: Statistical Analysis and Presentation

Goal: To judge the risk of bias related to the statistical analysis and presentation of results.

Statistical Analysis and Presentation Summary question:

After thorough reflection on all considerations, how would you describe the judgement about the overall risk of bias due to the statistical analysis?

☐ **Low risk of bias** ☐ **Moderate risk of bias** ☐ **High risk of bias**

Low risk – due to:

- Analysis reflects the study's objectives and the design of the study.
- The authors' explanation for analysis employed is sensible and clear. For a study with a causal understanding approach, a conceptual framework guides a thoughtful analysis.

Supplementary Table S2. Variables included per study

	Koopmans et al. (2008) [24]	Koopmans et al. (2008) [26]	Stapelfeldt et al. (2014) [25]	Ishtiak-Ahmed et al. (2014) [27]
Age	+	+	+	+
Gender	+	+		+
Sickness absence pattern	+	+	+	
Marital status	+	+		+
Education				+
Salary scale	+	+		
Seniority	+	+		
Type of workplace (urban/ rural)	+	+		
Working part-time/full-time	+	+		
Working environment (favorable/unfavorable)			+	
Total number of SA days			+	+
Country of birth				+
Occupation (care/non care)			+	
Place of residence (villages or (medium) sized cities				+
Length of hospital stay				+
Number of outpatient care visits				+